ABSTRACT

Title: 1 ligh Velocity Penetrator Missions for the Outer Planets

Authors: Henry 1 larris and Dr. Marc Adams

An attractive approach to low cost surface in situ missions for planetary exploration is to send an instrumented penetrator into the surface of a planetary body. It has long been assumed that such penetrators must be restricted to speeds of a few hundred meters per second in order to prevent destruction of the penetrator unless heavy rockets were included to slow down the penetrator prior to impact. Such heavy rockets drive up the mass and cost of such a mission. If a method could be found to assure survival of a penetrator at greater than 1km/s, smaller, faster, cheaper missions could be developed.

Over the past decade, JPL has been a leader in tasks on high velocity projectiles. This work involved theoretical analysis and experimental verification of new, powerful techniques for understanding high velocity impact processes. An important technique is the use of tuned impedances to prevent shock waves from reaching sensitive payloads, showing that it is possible to develop missiles which can survive high velocity impact. Much of this work has recently been made available. It has been proposed to apply these methods, already known to J]'],, to the problem of survival of a planetary penetrator.

In a new era of smaller, cheaper space missions, JPL is searching for methods to explore the solar system at much lower cost. A mission involving a survivable high speed penetrator is the simplest, cheapest way to do in situ surface exploration, 1 f this technology proves viable, a wide range of Discovery-class penetrator missions could result.

This paper describes a penetrator conceptual design, a mission to Europa that uses this technology and the experimental technique that has been proposed for the verification of the design.